CHAPTER 11
FILTRATION

11-1. GENERAL.

a. Filtration is the physical process of removing dirt particles and solids to prevent impeding the disinfection process. Filtration, capable of removing some bacteria, is *not* a disinfection process. Disinfection is the chemical process of killing disease-causing bacteria and other types of microorganisms by maintaining a uniformly dispersed residual of some chemical (usually chlorine) in pool waters.

b. The removal of bacteria by filtration is not considered particularly beneficial. The primary purpose of filtration is to remove all foreign particles which would otherwise increase the chlorine demand of the water, thus lowering chlorine residuals and weakening the killing power of the chemicals that have been added to sterilize the water.

c. Many alternatives are open to designers and builders to accomplish particle removal through filtration. Of these, two primary filter types will be considered: sand (or permanent media) and diatomite. Both filter systems, if properly designed, are equally efficient and acceptable in delivering effluents of equal quality.

11-2. RECIRCULATION PUMP THEORY OF OPERATION.

The typical swimming pool recirculation pump is a centrifugal pump which imparts energy to the water by centrifugal force. Water is drawn into the eye of an impeller and then thrown from the outer perimeter of the whirling impeller into the volute or chamber enclosing the impeller. From the volute the water is forced into the piping system. If the water has been filtered prior to reaching the pump (at the suction side of the pump), it is discharged from the pump directly back to the pool. The filter system may be either a vacuum or gravity system. If the water has not been filtered, it is discharged from the pump to the filter station and then on to the pool. This system is described as a pressure system since the water is then normally delivered to the filters under pressure. Regardless of the system used, the hydraulic conditions encountered are much the same.

11-3. OPERATING PARAMETERS.

a. As the soil removal process takes place in the filter medium, the dirt accumulation increases resistance to flow and eventually reduces the flow below the specified amount. At that point the filter must be cleaned. Conversely, when the filter is cleaned and returned to service, resistance to flow is at its minimum and flow is at its maximum. Thus, it can be seen that the swimming pool pump output varies constantly from beginning to end of the filter cycle. It is important to note that a large variation in the specified flow rate is undesirable. As filter clogging increases resistance, reduction of the filtration rate is obviously undesirable. At the other extreme, flow well above the designed filtration rate may shorten filter cycles.

b. As a practical matter the designer chooses the swimming pool pump by totaling all the resistances to flow which will be encountered in the circulation system and adding the resistance which will be encountered due to soil accumulation during the filter cycle. Using the sum of these resistances, the designer selects a pump which will deliver the desired flow against all the controllable conditions which are expected to be encountered in a properly operated system. The operator then becomes responsible for carrying out the intent of the designer. At the outset of the filter cycle the operator must adjust the flow control valve to protect the system against too high a flow. As the cycle progresses the operator must continue to adjust the control valve to keep the flow rate at its desired setting. When adjustments will not maintain adequate flow (due to dirt accumulation in the filter), the filter must be cleaned and restarted on a new cycle. All throttling of the recirculation pump should be done on the discharge side of the pump, never on the suction side.

11-4. FILTER TYPES.

The following five filter types are traditionally acceptable: (1) pressure sand, (2) pressure diatomaceous earth, (3) vacuum diatomaceous earth, (4) gravity sand, and (5) cartridge filters. The first three types are predominantly in use today.

11-5. CHARACTERISTICS.

From the viewpoint of soil removal efficiency, the three systems are considered relatively equal. However, each system possesses its own unique characteristics with respect to operating procedures and hydraulic response to dirt loading. For discussion, these filter types are divided into two general categories: (1) permanent media filters (predominantly sand, although anthracite is sometimes used) in which the filter medium remains in the filter after the soil load is

backwashed to a waste disposal area or sewer, and (2) disposable media filters (predominantly diatomaceous earth) in which the filtering medium and the accumulated soil are disposed of together. A new supply of the filter medium is deposited in the filter for each cycle. Volcanic ash and specially processed pumice are sometimes employed as filter aids in place of diatomaceous earth.